Velcon®

Clay Element Information

CLAY TREATMENT OF TURBINE FUEL

Surfactant contamination in turbine fuels has been attributed to the following sources:

1. **Refinery –** Naphthenic and sulfonic acids; also sodium naphthenates and sulfonates formed during acid and caustic treating.

2. **Pipelines and transport trucks –** Residuals from motor gasolines and heating oils adsorbed on pipe walls – then desorbed into turbine fuel. Also, pipeline additives are surfactants.

3. **Ships and barges –** Same methods as in (2) above. Also, sea water and acids in the fuel can combine to form sodium naphthenates and sulfonates.

4. **Maintenance materials –** Soaps, detergents, and steam cleaning residues. Rust preventives and descaling chemicals usually are surfactants or combine to form surfactants.

The problems that are attributed to surfactants are principally related to their tendency to prevent the filter/separator from performing its functions, i.e., removing dirt and water from the fuel. The mechanics of this are a subject for a separate discussion but the results of such a failure are extensive. Water and dirt in an aircraft fuel system have well recognized dangers, but secondary effects are of equal importance. Bacteria can grow in the aircraft fuel system if water is present and the result can be corrosion of structural members and errors in the signals from fuel quantity gauging probes.

Treatment of fuel to remove surfactants is usually done with attapulgus clay. In the refinery, large towers are built to contain many tons of bulk clay in a percolation column. However, complications of handling bulk clay outside of a refinery have led the industry to use element-type clay vessels when it is necessary to treat the fuel in field installations.

The key to good results in clay treatment is to keep the fuel in contact with the clay for as long a time as possible. We call this “residence” time. If you look at a clay particle, you see what seems to be a grain of fine (60 to 90 mesh) sand. But if you look within the grain with a microscope, you find it is made up of smaller particles that cling together to form a porous mass. If we now examine these smaller particles with an electron microscope, we see that they contain thousands of tiny needle-like attapulgite crystals.

This photograph was taken at 35000X and was reproduced from technical literature of Minerals and Chemicals Philipp Corporation.

Scientists have calculated that one pound of attapulgite has about 13 acres of surface area.

It is clear that residence time, mentioned above, is required because the fuel must have enough time to penetrate the clay particle where the surfactant can be adsorbed onto the surfaces of the crystals. Extremely small dirt particles in the sub-micronic range are also adsorbed. This is why the oil industry and most filter manufacturers keep the flow rate per standard element very low – from 5 to 6 gpm, but never higher than 7 gpm. The industry is well standardized on 18" long elements, 7" diameter.

Referring once again to the construction of a clay particle, it was mentioned that the individual grains are made up of very small particles that cling together. The grains will not break down under normal conditions, but water can cause this to happen. To deter breakdown in the presence of water, Velcon Filters, Inc. uses an oven-treated grade of clay, known as LVM.

The improvement in operating life of coalescer elements when clay is installed is dramatic. At one location, 50,000 gallons were clogging Velcon Filters "9" series elements. Life jumped to 4 million gallons after clay was installed and the clay elements lasted 8 million gallons. In another installation, regular "6" series elements were lasting only 200,000 gallons. After clay was installed, life went up to 16 million gallons. The improvement in filter membrane color ratings is just as dramatic as the improvement in coalescer life.

Two types of elements are available for clay vessels. One is a bag element which contains a given quantity of clay inside a cloth bag. The second element is a rigid canister, which contains the same clay. Velcon only produces the canister type elements because they provide a more effective sealing mechanism between elements when they are stacked on top of one another in the clay vessels. This cuts down on by-passing caused by folds of the cloth of the bag element. Since the flow rates on clay elements are quite low, it is possible to have a significant amount of by-passing from relatively small apertures between the bag elements. Also, some competitors' bag elements and canisters contain less efficient 30–60 mesh clay. We encourage customers to use Velcon's canister type element (with 60–90 mesh) for the best performance and highest efficiency of clay treatment vessels.

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